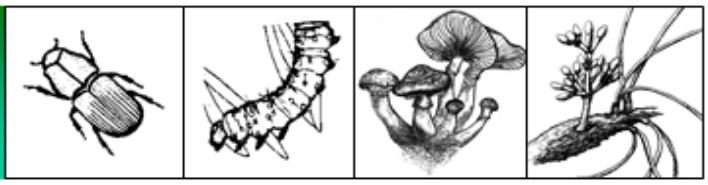
Forest Health Protection



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Using Aggregation Pheromones of Douglas-fir Beetle to Decrease Conifer Encroachment of Aspen Stands on the Superior Ranger District, Lolo National Forest-a Case Study

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Introduction

Aspen is an important component of forest vegetation that is managed by state, private and federal land managers. It provides multiple benefits for wildlife and other important resources across the state. Stands of aspen have been declining across many parts of Montana because of conifer encroachment, browsing damage and lack of wildfire. Fires play an important role in increasing sprouting or suckering to regenerate stands of aspen. Thinning or mechanical manipulation of aspen stands to improve stand vigor is often costly and rarely done. We propose a novel method to reduce conifer encroachment by baiting Douglas-fir trees with Douglas-fir beetle (DFB) pheromones to attract DFB to selected, larger trees in the Lost Creek drainage on the Lolo NF. Aggregation pheromones of DFB has been used successfully to create snags for improvement in wildlife habitat (Ross & Niwa 1997).

Objective

The primary objective was to evaluate the effects of using pheromone baits to kill select larger Douglas-fir trees competing with aspen. We were also interested in determining "spill over" or trees in the vicinity of the baited trees attacked and killed by DFB and the resultant improvement in aspen regeneration in growth and health.

Method

The study area was located in the Lost Creek drainage on the Superior Ranger District, Lolo NF. An approximate 20 acre area was chosen for the study that contained a declining aspen clone (two size and age classes represented) and competing Douglas-fir on a scree slope. Very little to no aspen regeneration was found in the forested patches around the scree where the aspen was confined. Some of the aspen in the interior of the plot were declining (sparse and chlorotic crowns) likely as a result of overstory Douglas-fir competition.

The Douglas-fir stands surrounding the aspen clone are highly susceptible to DFB-caused tree mortality. The basal area was approximately 180-200 ft^2/acre and the average stand diameter was 14 inches in d.b.h.

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In 2016, five trees were baited (Spruce beetle/Douglas-fir beetle enhanced tree bait; Synergy Semiochemicals) along the east and west borders of the aspen clone. We selected trees that were at least 16 inches in d.b.h. and spaced at least 50 feet from each other. In 2017, ten trees were baited that were at least 16 inches d.b.h. and were spaced at least 50 feet from each other in the vicinity of the 2016 baits and an expanded perimeter. In 2018, we did not bait because we decided that there was adequate DFB activity in the treatment area. Because DFB declined in 2018 (no baiting year), we baited an additional 10 trees in 2019. In the fall of each year following beetle flight, we evaluated if the baited tree and surrounding larger Douglas-fir trees were attacked by DFB (within 50 feet of baited trees).

At the end of the project in 2019, we conducted a 100% cruise of Douglas-fir trees over 8 inches d.b.h. within approximately 200 feet from the center of the aspen to evaluate DFB-caused tree mortality.

Results

In 2016 following beetle flight, only one of 5 baited trees was successfully attacked and two were unsuccessfully attacked by DFB. An unsuccessful attack is defined as trees containing adult galleries but do not contain brood. In 2017, 82 trees were successfully attacked and 14 trees were unsuccessfully attacked by DFB. In 2018 only 10 new attacks were detected (the year we did not bait). In 2019, 11 trees were successfully attacked and 7 were unsuccessfully attacked by DFB. Trees as large as 25 inches and as small as 8 inches in d.b.h. were attacked by DFB. Baited trees were almost always attacked during the year of baiting (over 90% attack rate) and most larger trees within 20 feet (greater than 8 inches d.b.h) were also attacked.

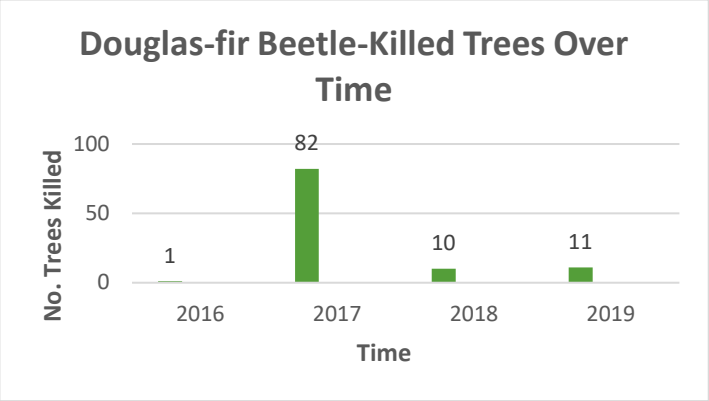

Figure 1. Chart showing number of Douglas-fir tree killed over time.

On this particular site, spread of Douglas-fir beetle-caused tree mortality across the slope was generally limited to within 50 feet of the baited trees. The spread of mortality up the slope was in excess of 150 feet, perhaps because the afternoon warm air moving upslope carried the pheromone plume into the trees in that area and attracting Douglas-fir beetles to the more susceptible trees.

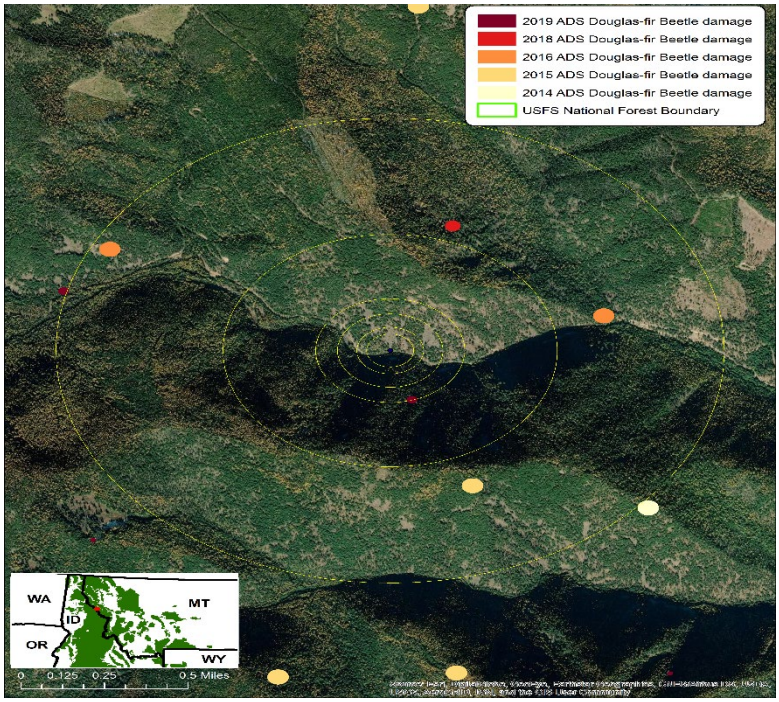

Figure 2. Showing low and scattered DFB activity in area during the study time period. Plot is located in the center of the bullseye.

Discussion

This case study demonstrated that DFB pheromone baits can successfully be used to initiate DFB activity and reduce conifer competition. There was no DFB activity in the stand prior to baiting in 2016 and limited DFB activity in the drainage over the course of the study (Figure 2). Following 4 years and 3 of those using baits, DFB activity remained within 200 feet of the aspen center. We also showed that DFB activity declined in the year that we did not bait. We also demonstrated that we were able to kill both dominant and co-dominant Douglas-fir trees with baits. In fact, trees as small as 8 inches d.b.h. were killed by beetles in the stand; some of these also contained brood. Although we did not measure the release or improvement in individual aspen, the photo series below shows an improvement in aspen habitat that should translate into improvement for individual trees over time (Figs. 3, 4 and 5). The 2017 photos were taken in the summer and the 2019 photos were taken in the fall; accounting for the difference in aspen foliage color.

Using pheromone baits to reduce Douglas-fir competition with aspen may be a feasible way to improve aspen habitat where appropriate. The value of this technique is the low cost, approximately $70-100/year/location and the ability to treat areas that are inaccessible, mechanical treatments are not desired, or the monetary value of treatment is low. Douglas-fir beetle activity was confined only to the treated-target area and did not result in increased DFB activity in the drainage (Figure 2).

This technique may be applicable to other beetles such as western balsam bark beetle and spruce beetle, all of which are considered non-aggressive and activity usually declines once beetles move into healthy, green trees. We caution to not use this method if DFB activity is elevated in an area unless additional widespread tree mortality is acceptable. Also, the use of insect-suppression methods such as applying the anti-aggregation pheromone, MCH, may be effective to protect high-value stands in the treatment vicinity where DFB-caused tree mortality is not desired.

Figure 3. Declining Number of Larger Douglas-fir Trees between 2017 and 2019, point one.

Figure 4. Declining Number of Larger Douglas-fir Trees between 2017 and 2019, point two

Figure 5. Declining Number of Larger Douglas-fir Trees between 2017 and 2019, point 3.

References

Ross, D. W.; Niwa, C.G. 1997. Using Aggregation and Antiaggregation pheromones of the Douglas-fir beetle to produce snags for wildlife habitat. West. J. Appl. For. 12(2):00-00.